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Oil Spray Recommendations

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Oil Spray Recommendations

By

R. H. Robinson and Leroy Childs

INTRODUCTION

THE recommendations presented in this Circular are suggested as a guide to the orchardist for oil spraying operations, with particular reference to apples and pears. For the most part the recommendations are based upon the work of members of the Western Cooperative Oil Spray Project, which comprises the experiment stations of Oregon, Washington, Idaho, Montana, British Columbia, and the U. S. Department of Agriculture. This work has been in progress during the past six years.

On account of the variable factors such as spray residue complications, severity of infestation and climatic conditions many of the recommendations may be modified to meet certain local conditions. Local authorities should be consulted for more detailed information concerning the recommendations.

Methods for the preparation of home-made emulsions and Tank-Mix oil spray are outlined.

DORMANT SPRAYS

1. Oil sprays have been found to be effective in the control of such insects as the San Jose scale, European red mite, brown mite, aphids, tree-hoppers and the fruit-tree leaf-roller.

2. Dormant-oil specifications: Straight-cut oils of 100° to 120° Saybolt viscosity that have a relatively low sulfonation test, which may vary between 50 and 70, are satisfactory. For dormant applications, the oil should be used at not less than 3¼ per cent actual oil (ordinarily 4 gallons of commercial emulsion or 5 gallons of home-made emulsion per 100 gallons).

3. Lime-sulfur is effective in the control of the San Jose scale, blister-mite, rust-mite, peach twig-borer, two-spotted mite, oyster-shell scale and also California peach blight and peach leaf-curl.

Lime-sulfur should be used at not less than 5° Baumé strength for San Jose scale control. This is equivalent to 12 gallons to 100 dilution of 32° Baumé lime-sulfur. For certain other insects such as blister-mite, two-spotted mite, and twig-miner a 4° Baumé strength lime-sulfur (8 gallons to 100) will suffice. Five pounds of dry lime-sulfur dissolved in water is equivalent, chemically, to about one gallon of 32° liquid lime-sulfur.

4. Whether oil emulsion or lime-sulfur is used as a dormant application depends on the insects or the fungous diseases to be controlled.

5. Oil emulsion or lime-sulfur should generally be applied in the spring, preferably before the bud scales separate and before the bud tips show green.

6. Injury may result if quick-breaking emulsions are applied during the critical period of bud development. This period occurs between the time the buds first show green and the cluster-bud stage.

7. Where it has been necessary to use oil at a later period, a miscible oil or an oil emulsion equivalent in stability has not ordinarily caused injury, when properly mixed and diluted to spray strength. The term "miscible oil" is applied to those emulsions in which the emulsifier is soluble in the oil.

8. Miscible oil should be diluted to spray strength by placing the oil in the tank first and, with the agitator running, adding the water slowly at first until a paste is formed, after which the tank can be filled with water in the ordinary manner. In no case should the miscible oil be added to the water. Hard water, when used with miscible oil, may cause a breaking of the emulsion which will result in injury to trees.

9. There is no evidence that low temperature following the application of sprays as suggested above will result in injury.

10. Severe injury to Delicious apple buds may result if lime-sulfur is applied as a delayed dormant spray.

SUMMER SPRAYS

1. The summer spray program should be planned to control the most important insects and diseases that are present in the orchard.

2. Summer applications of mineral oil are chiefly used for controlling the codling-moth, red spider-mites and leaf-hoppers. For the codling-moth they should be used in combination with other insecticides such as lead arsenate, cryolite, barium fluosilicate, or nicotine sulfate. With nicotine sulfate they constitute an excellent spray for aphids.

3. Certain fish-oils, when used with lead arsenate, have been found to improve materially the control of codling-moth. Fish-oil, however, is not recommended for use this season in Oregon, unless perhaps in the first cover spray, since it has been found to complicate the removal of the spray residue by the hydrochloric-acid washing process. A general recommendation covering fish-oils, therefore, will not be made until further data on washing tests are obtained.

4. Mineral oil with lead arsenate has given best results in the early cover sprays, especially when applied at the height of the egg-laying period of the insect pests. In this combination, a straight-cut oil having a viscosity of 65° to 75° Saybolt and a sulfonation test of not less than 85 has proved satisfactory. Oils having a viscosity exceeding 55° have produced injury to Newtown apples and other susceptible varieties, however, and the number of applications put on these varieties should not exceed two.

5. Summer oil specifications: It is important that the summer oils fulfill certain specifications. Either a "Light Medium" or a "Medium" oil 62° to 75° viscosity should be used. The Medium grade oil may be used advantageously in the early cover sprays, and the Light or Light Medium oil should be used if applications are made after the middle of July. The distillation range specifications are as follows:

Light Medium. 50 to 64 per cent of the oil should distill at 636° F.
Not more than 10 per cent should distill at 530° F.
Not less than 80 per cent should distill at 715° F.

Medium. 40 to 49 per cent of the oil should distill at 636° F.
Not more than 10 per cent should distill at 540° F.
Not less than 80 per cent should distill at 725° F.

Newtown and other susceptible varieties of apples have developed severe injury around the calyx when the Light Medium or Medium grade of oil has been used. It is necessary, therefore, to use a "Light" oil, having a viscosity between 50° and 55° Saybolt on these susceptible varieties. The distillation range specification for this oil is as follows:

Light. 65 to 100 per cent of the oil should distill at 636° F.
Not more than 10 per cent should distill at 520° F.
Not less than 80 per cent should distill at 665° F.

6. Mineral oil should be used at the rate of one gallon of emulsion to 100 gallons of water, particularly when red spider-mites are present, and the lead arsenate should be used at the rate of two pounds to 100 gallons. Lime or a spreader containing lime (½ pound per 100) should be used in this combination.

7. Difficulty in removing spray residue may be expected from the combination of mineral oil and lead arsenate if used after the first brood sprays. An oil-nicotine-sulfate (emulsion 1 gallon, nicotine sulfate ½ pint to 100 gallons) may be used later, otherwise the lead arsenate should be used alone.

8. Where the codling-moth or other orchard pests require the use of a mineral oil in the first and second cover sprays, lime-sulfur should not be used previously in either dormant or summer applications on account of possible injury.

9. Oil sprays interfere with leaf metabolism, and the number of applications that can be given without retarding or checking the normal development of the fruit and fruit buds is limited by such factors as: (a) heavy fruit load on the tree at the time of application; (b) lack of sufficient water and plant food available in the soil; (c) high temperatures combined with high humidity at the time of application; (d) poor health of the tree as to root injury, etc.

10. CAUTION: Oils in combination with lead arsenate should not be allowed to stand in pipes or spray tanks, but should be applied immediately after being mixed. Fruit sprayed with this combination after the spray has been allowed to stand in the pipes of stationary outfits for some time can be cleaned effectively only with great difficulty.

11. In preparing a spray mixture of mineral oil and lead arsenate, the oil emulsion should be placed in the tank first and ½ pound of lime or spreader containing lime added. The water should then be turned in and when the tank is nearly full the lead arsenate should be added. Broken oil emulsions should not be used.

12. If fruit remains on the tree too long, or is allowed to stand in the orchard or common storage before washing, wax forms, which will increase the washing problem. Cleaning is further complicated if more than two oil sprays have been applied. Fruit should be harvested at the proper time and washed immediately after being picked.

HOME-PREPARED OIL SPRAYS

On account of present economic conditions, numerous requests have been made for methods of preparing home-made emulsions. The careful orchardist may find it advantageous and advisable to use either home-prepared oil emulsions or a recently perfected Tank-Mix oil spray. The cost of these sprays is about one-half that of the commercial product. It is necessary to emphasize that more than ordinary care should be exercised in the preparation of either of these types of spray. Otherwise an imperfect spray will be produced that may cause severe plant and fruit injury.

Concentrated home-prepared emulsion. A stock supply of concentrated emulsion similar to the commercial product may be prepared in the spray tank and stored for subsequent use in 50-gallon drums. The emulsions may be used for either dormant or summer spraying, but each supply should be prepared immediately previous to the respective spraying season. The emulsions should be stored in a cool place, since both cold weather conditions (below 36° F.) and the heat of summer will cause the emulsions to break down. A broken emulsion must not be used.

If a 300-gallon spray tank is available in which to prepare the emulsion, the following formula may be used. If the spray tank is 200-gallons capacity one-half of the formula should be used:

Oil	100 gallons
Water	33 gallons
Casein (finely powdered)	3 pounds
Ammonia (28% solution)	1 quart

Preparation of emulsion:

1. Put the required amount of water in the spray tank and with the *pump running* add the ammonia.
2. Sift the casein in slowly, allowing 2 minutes for it to dissolve.
3. Let the oil run into the tank *slowly* from the drum through the inch bung-hole.
4. After the mixture has been thoroughly stirred by the agitator for 2 minutes, pump it through the spray nozzle (opened up wide), at about 250 pounds pressure, into empty drums for storage until it is to be used. A second pumping is advisable if it is to be stored longer than two weeks.

PRECAUTIONS: The oil should not be added too rapidly or a "reverse" emulsion may form. This will not mix with water and must not be used.

Emulsions should not be made during freezing weather or the "reverse" type of emulsion may form.

It is best to keep the nozzle submerged below the surface of the emulsion as it is pumped into the storage drum. The nozzle will not reach to the bottom of the drum, but should be inserted as far down as possible.

Best emulsions are made when the water and oil are maintained at a temperature between 60° and 70° Fahrenheit.

Care should be taken to obtain the dormant oil for dormant spraying, and the proper summer oil specified above for summer spraying.

Further information regarding oil and the source for obtaining casein and ammonia may be obtained by writing R. H. Robinson, Experiment Station Chemist, Corvallis, Oregon.

Tank-Mix oil sprays. Another type of home-prepared oil spray is the "Tank-Mix" form perfected by R. H. Smith for use on citrus fruits. This is a mechanical mixture that may be prepared in the tank at the orchard at the time of spraying. The spray consists of oil mechanically mixed in the spray tank where a high-speed agitator keeps the oil broken into fine droplets and partly stabilized by a dispersive agent. Uniformity of the mixture is attained by the vigorous action of a high-speed agitator. This principle of spray preparation must not be employed where spraying equipment is obsolete or of low motive power. Six to 8 horse-power should be the minimum. The agitator should be geared to run at a speed of about 225 r.p.m. and should be equipped with three or four relatively large agitators (6 to 6½ inches in length) in the ordinary sprayer. Most spraying equipment must be changed to satisfy these requirements in order to prepare properly the Tank-Mix spray. These and related phases of the subject will be discussed at greater length in a bulletin to be issued by this Station in the near future.

Experimental work carried on at the Hood River Branch Station has shown that two dispersive agents give satisfactory results: (1) blood albumen mixed with 2 parts of fullers' earth; (2) casein-lime spreader (or pure casein dissolved in ammonia). For each 100 gallons of the spray, irrespective of the amount of oil used, use 3 ounces of the mixture of blood albumen and fullers' earth, or ½ pound of the casein-lime spreader (or 2 ounces of casein dissolved in 2 ounces of ammonia). Limited dormant spraying tests have shown that somewhat less bud retardation has followed when the blood albumen was used than when the casein-lime spreader was used. Until further experimental observations are made, the blood albumen is recommended as superior.

Preparation of Tank-Mix oil spray:

1. Start agitator (225 r.p.m.) and fill spray tank about one-third full of water.
2. Mix the required amount of dispersive agent with a little water to avoid lumping, add to the tank, and allow agitation to continue for about a minute.

3. Add the required amount of oil and immediately fill the tank with water. The spray is now ready for application. Maintain the agitator at 225 r.p.m. until the tank is empty.

4. If lead arsenate is to be used in the mixture add it just before beginning to spray.

PRECAUTIONS: It is most important that the speed of the agitator be maintained at about 225 r.p.m. throughout the entire period of spraying. Otherwise spray injury may occur.

The Tank-Mix oil spray may be used for either dormant or summer spraying, but care should be exercised to obtain the proper oil specified above. The blood albumen used in Tank-Mix oil sprays is a special water-soluble product.

If pure casein is used as the dispersive agent instead of casein-lime spreader or blood albumen, dissolve 2 ounces in a pint of water to which has been added 2 ounces of 28 per cent ammonia. This is the amount to use in 100 gallons of the spray.

If the blood albumen mixture or casein cannot be obtained locally, write to R. H. Robinson regarding source of supply.

The Tank-Mix oil sprays have performed similarly to the quick-breaking emulsion in so far as they affected foliage and bud development, and may be used for both dormant and summer spraying. They should not be used during the critical period of bud development.

The orchardist must recognize that this is the first time the Tank-Mix spray has been recommended, and should learn its limitations. Three years of experimental tests at Hood River have demonstrated its practicability, and during the coming season growers should make commercial tests of the method to determine its workability.